WHAT IS CLAIMED IS:

1. A gain controller, comprising:

an amplifier connected in series to a major optical channel of a wavelength division multiplexing (WDM) system, wherein the amplifier has an input terminal and an output terminal and the major optical channel has multiple sub-channels to transmit light signals with different wavelengths;

a power detector and filter controlling unit connected to the input terminal of the amplifier to detect power changes in the major optical channel;

a tunable filter having an input terminal connected the output terminal of the amplifier to output a specific light signal on one of the sub-channels by filtering wavelengths to the input terminal, wherein the tunable filter is connected to the power detector and filter controlling unit; and

a wavelength dependent attenuator connected between the input terminal of the amplifier and the tunable filter to adjust power of the specific light signal and then output the specific light signal to the input terminal of the amplifier;

whereby the power detector and filter controlling unit detects power changes of the major optical channel and then controls the tunable filter output specific light signals to the input terminal of the amplifier through the wavelength dependent attenuator to keep the power of the major optical channel in a valuable range.

2. The gain controller as claimed in claim 1, further comprising:

a first splitter connected in series to the major optical channel and having outputs and inputs, wherein the outputs are respectively connected to the input

terminal of the amplifier and the power detector and filter controlling unit and one of the inputs is connected to the wavelength dependent attenuator; and

a second splitter connected in series to the major optical channel and having outputs and inputs, wherein one of the inputs of the second splitter is connected to the output terminal of the amplifier and one of outputs of the second splitter is connected to the tunable filter.

3. The gain controller as claimed in claim 1, further comprising:

a mixer connected in series to the major optical channel and having an output and inputs, wherein the output is connected to the input terminal of the amplifier and one input is connected to the wavelength dependent attenuator;

a first splitter connected to the major optical channel in serial and having an input and two outputs, wherein one input is connected to the input of the mixer and the other output is connected to the power detector and filter controlling unit; and

a second splitter connected to the major optical channel in serial and having outputs and inputs, wherein one of the inputs of the second splitter is connected to the output terminal of the amplifier and one of outputs of the second splitter is connected to the tunable filter.

4. The gain controller as claimed in claim 1, wherein the amplifier is an Erbium Doped Fiber Amplifier (EDFA) type.